

of the transducer array, thereby preventing damage to the transducer array and poor yields in the manufacturing process. Unlike the prior art, the backing block assembly is not made until the backing material has been prepared, cured, and formed as plates, a concept not found in the cited references.

As discussed on page 2 of the specification of this case, Kawabe et al. is distinctly different and uses the prior art approach of casting a backing material behind the transducer array. It does this only after the painstaking task of soldering all of the connections to the back of the array, and then folding the printed wiring boards at right angles, which is purported to be possible without breaking or changing the impedances of the conductors. Casting the backing material on the transducer array is known to produce yield problems, as the prospect for damage to the array is always present. In addition to that, Kawabe et al. suggest that their printed wiring boards will all be folded up from the array in parallel while the casting is done, a difficult challenge due to their fine spacing and flexibility.

The Kawabe et al. device behind the transducer has only two components: the printed wiring boards and the cast backing. In contrast, the backing block of an embodiment of Claim 1 has three components: plates of backing material, printed circuit substrates, and adhesive. A person examining devices made by Kawabe et al. and by the present inventors, which can be easily done by cutting into the backing, would see the two components in the Kawabe et al. device, but in the inventive device the distinctive layers of the printed circuits, the backing plates, and the bonding adhesive are readily identified. Amended Claim 1 cannot read on the Kawabe et al. device because the adhesive layer is not present. It is thus evident that an anticipation rejection as given here cannot stand.

The Examiner points to the mention of epoxy in the last paragraph of column 7 of Kawabe et al. However this is not a reference to a separate epoxy or an epoxy functioning as described in the present application; it is a statement that epoxy is one of the substances of the described casting compound. It is a well-known principle that one element of an accused device cannot serve as two elements of an applied claim, which is what must be done here when Kawabe et al.'s epoxy is needed to serve as both the backing and the adhesive of amended Claim 1.

As stated above, among the advantages of the present invention are the ability to assemble the conductive backing block assembly from preformed components without casting and

curing, and to do so separate from the transducer array so that the transducer array is not damaged in the process. Neither advantage is present in Kawabe et al. The Examiner brushes aside these differences by saying that

"It would have been obvious to one of ordinary skill in the art to modify Kawabe et al by using a pre-formed plate and adhesive for the purpose of reducing drying time of the finished device."

This obviousness-type rejection is made without any indication of prior art to support it. Using pre-formed plates and adhesive can only be found in the present specification; the inventor's inventive concepts are being used against him.

Reducing drying time is not an advantage, because drying time is needed in the formation of the backing block plates prior to construction of the backing block assembly. Moreover, the process generally is done by casting and curing a block of backing material which must then be ground into plates of the desired thickness as described on page 5 of the specification. This is an extra process which Kawabe do not have to do.

Furthermore, it would be impractical for Kawabe to use pre-formed plates, because his wiring circuits are staked in fixed positions to the back of the transducer array when the time comes to form the backing. The wiring circuits cannot be moved laterally to seamlessly fill spaces between the circuits and pre-formed plates, which will leave sources of reflection and reverberation in the backing. With the wiring circuits staked in position, Kawabe et al.'s only alternative is to cast the backing on the back of the array, the standard prior art approach.

In summary, it is respectfully submitted that Claims 1-8 cannot be anticipated by Kawabe et al. because the third element of the claimed backing block assembly, the adhesive, cannot be found in Kawabe et al. Kawabe et al. only use an epoxy as one of the materials in his casting mixture for the backing, the usual prior art approach. The statement on page 4 of the Office action as to the obviousness of a pre-formed plate and adhesive shows that the anticipation rejection of Claims 1-8 cannot stand, and uses elements which are only found in the present specification, not the prior art. For these reasons it is respectfully submitted that Claims 1-8 as amended cannot be anticipated by Kawabe et al.

Claims 17-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawabe et al. Amended Claims 17 describes a conductive backing block assembly for a two dimensional ultrasonic transducer array comprising preformed

plates of acoustic backing material; printed circuit substrates located between the plates of acoustic backing material and having conductive traces; and adhesive located between the adjoining surfaces of the plates and printed circuit substrates to bond the preformed plates and printed circuit substrates into a unitary backing block assembly. The Examiner acknowledges that Kawabe et al. do not disclose separate plates and adhesive, but contends that separating one element into two is an obvious modification. It is respectfully submitted that Claim 17 recites three separate and distinct elements: 1) preformed backing material plates; 2) printed circuit substrates; and 3) adhesive. The plates and adhesive are separate elements, and must be found as such in any practice of the claim. The Examiner, having noted that Kawabe et al.'s backing compound mixture includes epoxy resin, would seemingly unmix the compound to "separate" the mixture into two. This is not a separation of one element into two: it is the creation of a different element by hindsight reference to applicant's invention. The follow-on obviousness ground, that it would have been obvious to modify Kawabe et al. by using a pre-formed plate and adhesive for the purpose of reducing drying time of the device, is only obvious by referring to the present invention, for the use of pre-formed plates and adhesive are not found in Kawabe et al. or in any other reference. It is respectfully submitted that applicant's teaching cannot be used to provide a missing element needed for an obviousness rejection, and that therefore Claims 17-19 are patentable over Kawabe et al.

Claims 24-27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawabe et al., apparently because the first element of Claim 24, a two dimensional array of micromachined ultrasonic transducer elements, was disregarded as not being a structural limitation. It is respectfully submitted that micromachined ultrasonic transducers (known in the art as MUTs), are well known as being defined structural elements. See the enclosed paper "Micromachined Ultrasonic Transducers (MUTs)" from Stanford University and the patents entitled "Ultrasonic Micro-machined Selectable Transducer Array" and "Capacitive Micromachined Ultrasonic Transducers with Improved Capacitive Response." It is respectfully submitted that a two dimensional micromachined transducer array with a conductive backing block assembly of bonded backing material plates and printed circuit substrates as described in Claims 24-27 are not shown or suggested by any of the prior art references.

In view of the clarification given Claims 1 and 17 to highlight the different structural elements of the claimed devices as discussed above, it is respectfully submitted that Claims 1-8, 17-19, and 24-27 are patentable over Kawabe et al. It is further respectfully submitted that micromachined ultrasonic transducers are well known in the art as distinctive structural device. It is therefore respectfully requested that the rejection of Claims 1-8 under 35 U.S.C. §102(b) and of Claims 17-19 and 24-27 under 35 U.S.C. §103(a), be withdrawn and the case passed on to issuance.

The recently received (August 27) search report from the corresponding European case is also enclosed for the Examiner's consideration. In light of the above amendments it is believed that the claims herein are patentably distinct over the citation of the EPO report.

In light of the foregoing amendment and remarks, it is respectfully submitted that this application is now in condition for allowance. Favorable reconsideration is respectfully requested.

Respectfully submitted,

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Appendix: Version with markings to show changes made

1. (Amended) A two dimensional ultrasonic transducer array probe comprising:

a two dimensional array of ultrasonic transducer elements having a bottom surface from which undesired ultrasonic energy is emitted; and

a conductive backing block assembly affixed in opposition to the bottom surface of the two dimensional array which comprises:

separate preformed [alternating] plates of acoustic backing material; [and]

printed circuit substrates with conductive traces alternately located between ones of the separate preformed plates; and [, the separate plates and printed circuit substrates being bonded together with]

adhesive located between the adjoining surfaces of the plates and the printed circuit substrates to bond the plates of acoustic backing material and printed circuit substrates into a unitary backing block structure.

17. (Amended) A conductive backing block assembly for a two dimensional ultrasonic transducer array comprising:

preformed plates of acoustic backing material; [and]

printed circuit substrates located between the plates of acoustic backing material and having conductive traces; [,] and

[wherein the plates and printed circuit substrates are bonded together with]

adhesive located between the adjoining surfaces of the plates and printed circuit substrates to bond the preformed plates and printed circuit substrates into a unitary backing block assembly.